

### **REMARKS**

This responds to the Office Action mailed on September 1, 2004. By this amendment, claims 1, 28, 31 and 39 are amended, and claim 40 was added. No claims were canceled. No new subject matter was added. As a result, claims 1-19 and 28-40 are now pending in this application.

#### **§103 Rejection of the Claims**

**A. Rejection:** Claims 1-5, 8, 9, 12-14, 16, 18, 19, 31-39 were rejected under 35 USC § 103(a) as being unpatentable over Marlin (U.S. 6,429,046) in view of admitted prior art (APA).

**B. Response:** In the office action of September 1, 2004, the Examiner set forth the standard 103(a) language, and then stated that claims 1-5, 8, 9, 12-14, 16, 18, 19, 31-39 are rejected under 102(b). The Examiner then continues the rejection and cited a combination of art as the basis for the rejection.

In a telephone interview with the Examiner, Applicant's attorney asked if the Examiner's first rejection was a rejection under 35 USC § 103(a) rather than a rejection under 35 USC § 102(b). The Examiner confirmed that the intended basis for the rejection was 35 USC § 103(a). Accordingly, Applicant's attorney restated the rejection above with 35 USC § 103(a) as the basis.

In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference or references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991)).

The rejection of claim 1 is now overcome since the Examiner fails to make out a improper *prima facie* case of obviousness with respect to claim 1 as now amended. Claim 1 recites "...a solder ball formed on at least one of the array of pads, at least one of the array of pads including a diffusion retarding layer for controlling the out-diffusion of the electrically conductive material from the at least one pad during a solder reflow process."

The combination of Marlin and the admitted prior art (APA) does not teach or suggest all the elements of claim 1. Marlin does not teach or suggest the element of a diffusion retarding layer for controlling the out-diffusion of the electrically conductive material from the at least one pad during a solder reflow process. The Marlin reference teaches a layer to prevent diffusion (See column 2, line 7 of the Marlin reference). The APA also does not mention diffusion barriers and therefore does not supply this missing element. Therefore, at best, combining the diffusion barrier of Marlin with the APA yields a barrier that prevents diffusion rather than a diffusion retarding layer. As a result, the combination of the Marlin reference and the APA relied upon by the Examiner fails to disclose each element as recited in claim 1. Accordingly, applicant believes that the Examiner's rejection of claim 1 is overcome since the Marlin and the APA fails to teach or suggest all the elements of claim 1.

Claims 2-5, 8, 9, 12 and 13 depend, either directly, or from claim 1 and include the limitations of claim 1 by their dependency. As a result, applicant believes that the Examiner's rejection of claims 1-5, 8, 9, 12 and 13 are now also improper since the combination of the Marlin reference and the APA fails to show all the elements of each of these claims.

Claim 14 as now amended recites "...a diffusion retarding layer placed over the at least one pad..." As mentioned above, the diffusion layer of Marlin prevents diffusion rather than retarding diffusion. The APA does not mention a diffusion barrier. Consequently, the combination of Marlin and the APA does not teach or suggest all the elements of claim 14.

Claims 16, 18, and 19 depend directly from claim 14 and include the limitations of claim 14 by their dependency. As a result, applicant believes that the Examiner's rejection of claims 14, 16, 18, and 19 are now also improper since the combination of the Marlin reference and the APA fails to show all the elements of each of these claims.

Claim 31 recites "...means to retard diffusion of the copper associated with the copper pad adapted to retard the out-diffusion of the copper from the pad during a solder reflow

process.” As mentioned above, the diffusion layer of Marlin prevents diffusion rather than retarding diffusion. The APA does not mention a diffusion barrier. Consequently, the combination of Marlin and the APA does not teach or suggest all the elements of claim 31.

Claims 32-34 depend directly from claim 31 and include the limitations of claim 31 by their dependency. As a result, applicant believes that the Examiner’s rejection of claims 32-34 are now also improper since the combination of the Marlin reference and the APA fails to show all the elements of each of these claims.

Claim 35 recites “...means to retard diffusion of the copper associated with the copper pad ...” As mentioned above, the diffusion layer of Marlin prevents diffusion rather than retarding diffusion. The APA does not mention a diffusion barrier. Consequently, the combination of Marlin and the APA does not teach or suggest all the elements of claim 31.

Claims 36-39 depend, either directly or indirectly, from claim 35 and include the limitations of claim 35 by their dependency. As a result, applicant believes that the Examiner’s rejection of claims 36-39 are now also improper since the combination of the Marlin reference and the APA fails to show all the elements of each of these claims.

**C. Rejection:** Claims 10 and 11 were rejected under 35 USC § 103(a) as being unpatentable over Marlin and APA as applied to claim 1 above, and further in view of Andricacos et al. (U.S. 6,224,690).

**D. Response:** Claims 10 and 11 depend indirectly from claim 1 and include the limitations of claim 1 by their dependency. As a result, applicant believes that the Examiner’s rejection of claims 10 and 11 are now also improper since the combination of the Marlin reference, the APA and the Andricacos et al. reference fails to show all the elements of each of these claims. Specifically, the combination of Marlin, the APA, and the Andricacos et al. reference does not teach or suggest a solder ball formed on at least one of the array of pads, at least one of the array of pads including a diffusion retarding layer for controlling the out-diffusion of the electrically conductive material from the at least one pad during a solder reflow process. Rather the combination of Marlin, the APA, the Andricacos et al. reference would

result in a diffusion prevention barrier. There is no motivation in the references to modify the references to yield applicant's invention, as claimed.

**E. Rejection:** Claims 6, 7, 15, and 17 were rejected under 35 USC § 103(a) as being unpatentable over Marlin and APA as applied to claims 1 and 14 above, and further in view of Andricacos and Okamoto et al. (U.S. 5,521,438).

**F. Response:** Claims 6 and 7 depend directly from claim 1 and include the limitations of claim 1 by their dependency. As a result, applicant believes that the Examiner's rejection of claims 6 and 7 are now also improper since the combination of the Marlin reference, the APA, the Andricacos et al. reference, and the Okamoto et al. reference fails to show all the elements of each of these claims. Specifically, the combination of Marlin, the APA, the Andricacos et al., and the Okamoto et al. reference does not teach or suggest a solder ball formed on at least one of the array of pads, at least one of the array of pads including a diffusion retarding layer for controlling the out-diffusion of the electrically conductive material from the at least one pad during a solder reflow process. The Okamoto et al. reference is directed toward joining a metallic member, such as an input/output terminal, by solder to a ceramic base by way of a stress layer (see abstract). The Examiner contends that the structure taught in the Okamoto et al. reference is for preventing further diffusion of an intermetallic, however, there is no mention of diffusion in the Okamoto et al. reference. At best the combination of Marlin, the APA, the Andricacos et al. reference would result in a diffusion prevention barrier and a stress relief portion. There is no motivation in the references to modify the references to yield applicant's invention, as claimed, to yield a diffusion retarding layer for controlling the out-diffusion of the electrically conductive material from the at least one pad during a solder reflow process.

Claims 15 and 17 depend directly from claim 14 and include the limitations of claim 14 by their dependency. As a result, applicant believes that the Examiner's rejection of claims 15 and 17 are now also improper since the combination of the Marlin reference, the APA, the Andricacos et al. reference, and the Okamoto et al. reference fails to show all the elements of each of these claims. Specifically, the combination of Marlin, the APA, the Andricacos et al., and the Okamoto et al. reference does not teach or suggest a diffusion retarding layer placed over

the at least one pad. The diffusion layer of Marlin prevents diffusion rather than retarding diffusion. The APA, Andricacos et al reference or the Okamoto et al reference does not mention a diffusion barrier. Consequently, the combination of the Marlin reference, the APA, the Andricacos et al. reference, and the Okamoto et al. reference fails to does not teach or suggest all the elements of claim 15 and claim 17.

Applicant disagrees that it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the diffusion retarding layer including Kovar or a composition 54Fe-29Ni-17Co as taught by Andricacos et al. and Okamoto et al. so that diffusion resistance and adhesion/bonding can be improved in the APA and Marlin's device. There is no basis in the art or stated by the Examiner that would lead one of ordinary skill to combine these references.

**G. Rejection:** Claims 28-30 were rejected under 35 USC § 103(a) as being unpatentable over Marlin and APA as applied to claim 1, and further in view of Andricacos et al. and Shimokawa et al. (U.S. 2002/0163085).

**H. Response:** Claim 28 recites "...a diffusion retarding layer placed on at least one of the array of pads; and solder placed on at least one of the array of pads, the solder and the pad including a intermetallic compound including Ni-Sn ( $\text{Ni}_3\text{Sn}_4$ ) and Sn-Fe." The references cited do not teach or suggest the combination of a diffusion retarding layer and the specific intermetallic alloys recited in claim 28. Accordingly, claim 28 overcomes the Examiner's rejection under 35 USC 103(a). Claims 29 and 30 depend directly from claim 28 and add further limitations to the invention. As a result, claims 29 and 30 are also thought to overcome the Examiner's rejection.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney ((612) 373-6977) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

KUM FOO LEONG ET AL.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.  
Attorneys for Intel Corporation  
P.O. Box 2938  
Minneapolis, Minnesota 55402  
(612) 373-6977

Date 10/20/04

By Richard E. Billion  
Richard E. Billion  
Reg. No. 32,836

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: MS Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 20th day of October, 2004.

Amy Moriarty  
Name

Amy Moriarty  
Signature